BANGALORE WATER SUPPLY AND SEWERAGE BOARD

9th Floor, Cauvery Bhavan "D" Block,
K.G. Road, Bangalore 560009

Tender Document

of

Tender for the Work of Comprehensive operation and maintenance of RO plants based on the revenue sharing method coming under AEE(BW&PS)-1-3 subdivision (O&M-4- Total no-63).

(Through Karnataka Public Procurement Portal only)
https://www.kppp.karnataka.gov.in

Office of the Chief Engineer (Design & QA)
BANGALORE WATER SUPPLY & SEWERAGE BOARD
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BANGALORE WATER SUPPLY AND SEWERAGE BOARD
Office of The Chief Engineer (Design & QA)
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IFT No.: BWSSB/CE(D&QA)/ACE/TA/1300/2025-26 Date:02.08.2025

SECTION 1

INVITATION FOR TENDER

(ONLY THROUGH KPPP)

1. The **Chief Engineer (Design & QA)** invites tenders from eligible tenderers, for Operation and Maintenance of RO Plants detailed in the table below. Tenderers are requested to submit their tender, EMD and details of their capability to undertake the tender (as detailed in ITT Clause-3 & 6) in the Karnataka Public Procurement Portal. Price tender will be opened only if the Tenderer is found to be qualified to execute the tendered works. Tenderers are advised to note the minimum qualification criteria specified in clause 3 of the Instructions to Tenderers to qualify for award of the contract.
2. Tender documents may be downloaded through Karnataka Public Procurement Portal www.kppp.karnataka.gov.in website only from 0**5.08.2025 to 22.08.2025** Interested Tenderers may obtain further information by accessing the same website.
3. Tenders must be accompanied by Earnest Money Deposit specified for the work in the Table below. EMD will have to be in any one of the forms as specified in the Tender document and shall have to be valid for **45** days beyond the validity of the tender.
4. The last date and time for receipt of tenders in the Electronic Tender Box in website (www.kppp.karnataka.gov.in) is**22.08.2025** upto **16:00 hrs.** The technical bids will be opened on **25.0.82025 at 16:05 hrs.** If the bid-opening day remains as public holiday, bids will be opened on the next working day at the original stipulated time.
5. The salient features of the tender are as detailed in the table below:

Sl. No	Name of the work	Tender processing fee	Amount put to tender (approx) in Rs.	Bid security (EMD) in Rs.	Period of completion
(1)	(2)	(3)	(4)	(5)	(6)

	Work Comprehensive operation and maintenance of RO plants based on the revenue sharing method coming under AEE(BW&PS)-1-3 subdivision (O&M-4-Total no-63)	As per Karnataka Public Procurement Portal.	**2,94,84,000**	**4,42,300**	**24 Months**

6. Other details can be seen in the tender documents.

7. EMD shall be paid through OTC, NEFT and DEBIT CARD & CREDIT CARD through Karnataka Public Procurement Portal Only. The value of the Bid Security / EMD is as mentioned in the table above in column no 5.

8. Tenderers can access tender documents from www.kppp.karnataka.gov.in website only and upload the required details; those are mentioned in different sections in the bid document in to electronic tender on the website. Scanned documents those are required to be furnished as per Section 2, 3 & 4 of the bid document shall be submitted through KP- Procurement Portal.

9. The Tender processing fee once paid will not be refunded.

10. The successful Tenderer would be required to furnish the performance **Bank Guarantee** from a Nationalized/Scheduled Indian Bank, with jurisdiction at Bangalore as specified, towards guarantee for completion of work within the stipulated period as mentioned in tender document.

11. Applications / requisitions from joint venture Firms are acceptable. and Each firm is permitted to form the Joint venture and participate the bid with only one firm.

12. Bangalore Water Supply and Sewerage Board (BWSSB) reserves the right to cancel or annul the entire or part of this process of invitation at any time without assigning any reasons.

13. Tenderers shall submit offers that comply with the requirements of the bid document.

Corrigendum / Modification / Corrections, if any will be published in the website only.

14. For any additional information regarding the above tender, the firms who are interested to quote, may contact office of the undersigned at the office address given below on all working days during office hours (10:00hours to 17:30 hours).

15. **Each bidder/Joint Ventures are allowed to participate not more than 3 O&M packages of RO plants tender invited by the BWSSB.**

16. **The bidder/Joint venture firm should be resident of the Karnataka state government and license should be registered in the Karnataka Government.**

17. **Prior to issuing of the work order, the accepted bidder should pay the 3 months security deposit amount for the total no of 63 RO plants in the package to the BWSSB.**

18. **The bidder selection will be based on the Highest quoted rate(H1 Selection)**

Bangalore Water Supply & Sewerage Board,
Office of Chief Engineer(Design & QA)9th Floor,
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Telephone No: 080-22945340

Chief Engineer
(Design & QA)
BWSSB

SECTION 2:

INSTRUCTIONS TO TENDERERS (ITT)
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A. General

1. Scope of Tender

1.1 The **Chief Engineer (Design & QA),**(Referred to as Employer in these documents) invites tenders following Two Stage Karnataka Public Procurement Portal procedure, from eligible Tenderers, for the Tender for the Work of Comprehensive operation and maintenance of RO plants based on the revenue sharing method coming under AEE(BW&PS)-1-3 subdivision (O&M-4- Total no-63) (as defined in these documents and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 Tenders from Joint ventures are acceptable. Each firm is permitted to form the Joint venture and participate the bid with only one firm.

3. Qualification of the Tenderer:

3.1 All Tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Qualification information.

3.2 To qualify for award of this contract, each Tenderer in its name should have in the last five years i.e. 2020-21 to 2024-25)

a. The Bidder should have achieved at least two financial years a minimum financial turnover of **Rs.589.68Lakhs** in the last five years (2020-21 to 2024-25) (in all classes of Civil Engineering/Electrical works only).

b. Satisfactorily completed as prime contractor at least one similar work such as **Comprehensive operation and maintenance of RO plants** in last five years of value not less than **Rs.147.42 Lakhs.**

c. Executed the following minimum **32 Nos** of operation and maintenance /new commissioning of RO plants in any one year during the last five years (2020-21 to 2024-25):

d. The tenderer should possess required valid KPWD license certificate

3.3Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than

the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*1.5 - B)> **Rs.2,94,84,000 /-**

Where,

A= Maximum value of civil engineering/Electrical works executed in any one year during the last five years (updated to 2024-25 price level at 10% per year) considering the completed as well as works in progress.

N= Number of years prescribed for completion of the works for which tenders are invited.

B= Value, at 2024-25 price level of existing commitments and on-going works to be completed during the next 2 years (period of completion of the works for which Tenders are invited)

3.4 In lieu with the conditions of contract, the intended Tenderer should inspect the site for its conditions and ensure that the provisions made for the items before quoting the tender.

3.5 Liquid assets and /or availability of credit facilities of not less than **Rs.88.45 Lakhs** (Credit lines/letter of credit/certificates from Nationalized / Schedule banks in India for meeting the fund requirement etc.

3.6 To qualify for a package of contracts made up of this and other contracts for which tenders are invited in this IFT, the tenderer must demonstrate having experience and resources to meet the aggregate of the qualifying criteria for the individual contracts.

3.7 Sub-contractors experience and resources shall not be taken into account in determining the Tenderers compliance with the qualifying criteria except to the extent stated in 3.2 above.

3.8 Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

3.9 Deleted.

3.10 Even though the Tenderers meet the above criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or

- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

3.11 Each bidder/Joint Ventures are allowed to participate not more than 3 O&M packages of RO plants tender invited by the BWSSB.

3.12 The bidder/Joint venture firm must be resident of Karnataka state government and license should be registered in Karnataka Government.

3.13 Prior to issuing of the work order, the successful bidder should pay the 3 months security deposit amount for the total no of 63 RO plants in the package to the BWSSB.

3.14The bidder selection will be based on the Highest quoted rate(H1 Selection)

4. One Tender per Tenderer:

4.1 Each tenderer shall submit only one tender for one package. A tenderer who submits or participates in more than one tender (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Tenderer's participation to be disqualified.

5. Cost of Tendering:

5.1 The tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible and liable for those costs.

6. Site Visit:

6.1The Tenderer at his own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The cost of visiting the Site shall be at the Tender's own expense.

B. Tender documents

7. Content of Tender documents

7.1 The set of tender documents shall have all the Sections given in Page 2:

7.2 Both the sets should be completed and returned with the tender.

8. Clarification of Tender Documents

8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer by posting in the web site (KPPP→My tenders→action→queries).All queries & replies can be viewed by all participating tenderers.

8.2 Pre-tender meeting: will be intimated through portal.

9. Amendment of Tender documents

9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the tender documents and shall be posted in the Karnataka Public Procurementwebsite for viewing by all the purchasers of the tender documents.

9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 16.2 below.

C. Preparation of Tenders

10. Documents comprising the Tender

10.1.1 The tender submitted in Karnataka Public ProcurementPortal by the Tenderer shall contain the documents as follows:

a) Scanned copy of Earnest Money Deposit.
b) The form of Tender (in the format indicated in Section 4)
c) Scanned copies of the certificates supporting the Qualification as in Section 3. Any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without exception. PHOTOCOPIES OF THE DOCUMENTS SHOULD BE NOTARISED.

10.1.2 Rates for the Bill of Quantities (Section 9) shall be quoted at the provision made in the Karnataka Public Procurementwebsite Portal.

10.2 Tenderers submitting tenders together with other contracts stated in the IFT to form a package will so indicate in the tender together with any discounts offered for the award of more than one contract.

11. Tender prices

11.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Tenderer.

11.2 The Tenderer shall fill in the unit rates in figures for all items of the Works described in the Bill of Quantities. The system will automatically convert the unit rates mentioned in figures to words and also calculate the amount of that item as well as the total Tender value.***Items for which no rate is entered by the Tenderer will not be paid for by the Employer when executed and shall be deemed covered by the other rates in the Bill of Quantities.***

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Tenderer.

11.4 The rates and prices quoted by the Tenderer shall be subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 40 of the Conditions of Contract.

12. Tender validity

12.1 Tenders shall remain valid for a period not less than **ninety days** after the deadline date for tender submission specified in Clause 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers responses shall be made in writing or by cable or e-mail. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause13 in all respects.

13. Earnest money deposit

13.1 Earnest Money Deposit shall be paid through Karnataka Public ProcurementPortal only using any of the following four modes.

i. Credit Card (Online Payment)

ii. Direct Debit Using Internet Banking (Online Payment)

iii. Remittance at the Bank Counter - Challan (Offline Payment)

iv. NEFT (Offline payment).

13.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days beyond the validity of the tender.

13.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 12.1.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The Earnest money deposit may be forfeited:

(a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;
(b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 24; or
(c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
(i) Sign the Agreement; or
(ii) Furnish the required Security deposit

14. Format and signing of Tender

14.1 The completed tender comprising of documents indicated in ITT 10, should be uploaded in the Karnataka Public Procurementwebsite along with scanned copies of requisite certificates those are

mentioned in different sections in the bid document and scanned copy of tender Security / EMD.

14.2 All the documents should be uploaded in Karnataka Public Procurementwebsite. Tenderer should take a print out of the Form of Tender in the Section 4 of the tender document on company letter head and should sign, stamp and upload the same to the tender. Authenticity of the signing authority shall be furnished. With this, it is taken that tenderer has signed & submitted the tender.

14.3 The Tender shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialed by the person signing the Tender.

D. Submission of Tenders

15. Up-loading & submission of tenders

15.1 The tenders should be uploaded only through Karnataka Public ProcurementWebsite. Tender should contain.

A. Technical Tender consisting of following:

a. All the documents with required details in prescribed format; those are mentioned in different sections in the Tender. Form of Tender, etc., shall be downloaded, filled with required details, signed, scanned& uploaded to the Karnataka Public ProcurementPortal (https://www.kppp.karnataka.gov.in)

b. The above documents along with notarized copies of documentary evidences as indicated in Section—2 of ITT, Section-3 Qualification information & Section-4 Forms of Tender shall be scanned and uploaded to the website compulsorily, failing which tender will be rejected in view of incomplete tender document and

B. Financial Tender consisting ofBill of Quantities

All rates for the items in the Schedule shall be posted in the work template provided in the tender document. Rates shall be entered in figures only and rates in words will be automatically generated.

15.2 Deleted

15.3 BID reference Number will be automatically generated by the server.

15.4 Deleted

16. Deadline for submission of the Tenders

16.1 Deleted.

16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with Clause 9, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

17. Late Tenders

17.1 The software of Karnataka Public Procurementwebsite system will not allow the Tenderer to upload the documents after expiration of the stipulated date & time of Bid submission. The Tenderer shall refer the

server time, which will be displayed in the Karnataka Public ProcurementPortal. BWSSB will not be responsible for non-receipt of bids on the stipulated date & time prescribed in clause 16, due to Internet Problems, improper uploading or any other related problems. In case of connectivity problems, Tenderer may contact Helpdesk of the Karnataka Public ProcurementPortal service provider and may also draw the attention of tender inviting authority.

18. Modification and Withdrawal of Tenders

18.1 Tenderers may "modify" and "withdraw" their tenders multiple numbers of times, until the deadline for submission of tenders by operating the relevant provision made in Karnataka Public ProcurementPortal. If the Tenderer withdraws the tender before the deadline for submission of tenders and later if he is interested to submit the tender once again, may do so within the stipulated date & time as mentioned in Clause 16. In this case within the stipulated date & time, the tenderer can once again submit the requisition to the officer inviting tenders for access to the withdrawn tender document for resubmission. For this tenderer need not make any additional payment towards the cost of tender document.Communication of modification / withdrawal by other means will not be accepted.

18.2 Deleted.

18.3 No Tender may be modified after the deadline for submission of Tenders.

18.4 Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 12.1 above or as extended pursuant to Clause 12.2 may result in the forfeiture of the earnest money deposit pursuant to Clause 13.

18.5 Tenderers may offer discounts for individual items by simply modifying the quoted unit price in the Bill of Quantities. Also, Tenderer may enter their overall discount, at specified location in the Bill of Quantities only, by submitting tender modifications in accordance with this clause. Communication of discount by other means will not be accepted.

E. <u>Tender opening and evaluation</u>

19. Opening of Technical Bid of Tenders and evaluation to determine qualified Tenderers:

19.1 The Employer will open the Technical details of all the Tenders received (except those withdrawn), including modifications made pursuant to Clause 18, in the presence of the Tenderers or their representatives who choose to attend at the Employer's office mentioned in the earlier para at 26.02.2024 16:00 Noon on the date and the place specified. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will

be opened at the appointed time and location on the next working day.

19.2 WITHDRAWAL proposal submitted pursuant to clause 18 shall be read out first and their bids shall not be opened.

19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening.

19.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 19.3.

19.5 The Price Tenders of all the Tenderers including modifications for financial tenders cannot be opened as this is programmed to open later after evaluation of the Technical details of the participating Tenderers.

19.6 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Clause 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Clause and (c) meets the minimum qualification criteria stipulated in ITT Clause 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Financial Bid of qualified Tenderers and evaluation:

20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the price Tenders. The Employer will open the price tender of Qualified Tenderers at the appointed time and date in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Price tender opening being declared a holiday for the Employer, the price tenders will be opened at the appointed time and location on the next working day.

20.2 Deleted.

20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, any discounts, and withdrawals, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. No Tender shall be rejected at Tender opening.

20.4 The Employer shall prepare minutes of the Price Tender opening, including the information disclosed to those present in accordance with Sub-Clause 20.3.

21. Process to be confidential

21.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

22. Clarification of Tenders

22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 24.

22.2 Subject to sub-clause 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer's Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers' Tender.

23. Examination of Tenders and determination of responsiveness

23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and; (b) is substantially responsive to the requirements of the Tender documents like (a)Form of Tender, (b)Declaration statement Scanned/ uploaded [including documents those are required to be furnished as per Section 2, 3 & 4 of the tender,]; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the tendering documents.

23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non conforming deviation or reservation.

24. Correction of errors

24.1 (a)Once the Tenderer key in the rates in figures, in the Bill of quantities provided, the system will automatically calculate the amount of that item as well as the total Bid value.

24.2 Deleted

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Clause 23.

25.2 In evaluating the Tenders, the Employer will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

(a) Making any correction for errors pursuant to Clause 24; and

(b) Making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Clause 18.5.

25.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Clause 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer's estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the Highest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to 5% of the Contract price plus additional security for unbalanced tenders in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract. :

- Cash or
- Banker's cheque/Demand draft,/Pay Order in favour of ***Chairman, BWSSB*** payable at ***Bangalore*** or
- A bank guarantee in the form given in Section 10;

29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank and valid in accordance with Clause 43 of Condition of Contract.

29.3 The security deposit if furnished in cash or demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

29.5 **Prior to issuing of the work order, the successful bidder should pay the 3 months security deposit amount for the total no of 63 RO plants in the package to the BWSSB.**

30 Advance Payment and Security:

30.1 Deleted

31. Corrupt or Fraudulent practices

31.1 The GOK requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GOK :

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

31.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 50.2 of the Conditions of Contract.

31. Sub Contract

The contractor may sub contract with the approval of the engineer but may not assign the contract without the approval of the employer in writing. Sub contracting does not alter the Contractor's obligations.

Note: MoU duly mentioning amount of work to be distributed; subject to maximum of 50% shall only be considered. The sub contractor should fulfill the condition mentioned.

SECTION 3:

QUALIFICATION INFORMATION

The following form is to be downloaded, particulars are to be filled, scanned & uploaded by the Tenderer.

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or legal status of Tenderer [Attach copy]
Place of Registration _____
(Attach Copy)
Principal place of business: _____

1.2 Total value of civil engineering/Electrical works executed and payments received in the last five years (in Rs. Lakh) [attach certificate of Chartered accountant]

2020 - 21 _____
2021 – 22 _____
2022 – 23 _____
2023 – 24 _____
2024 – 25 _____

1.3 Work performed as Prime Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of contract Rs. Lakh	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.4 Quantities of work executed as prime contractor (in the same name) during the last five years specified in 1.2 above: [to support the qualification criteria in ITT clause 3]

Year	Name of Work	Name of Employer	Quantity of work performed (cum)		Remarks (Indicate contract reference)
2020-21					
2021-22					

2022-23					
2023-24					
2024-25					

1.5 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place& State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. Lakh)	Stipulated period of completion	Value of works remaining to be completed (Rs. Lakh)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of Work	Place & State	Name and Address of Employer	Estimated value of works (Rs. Lakh)	Stipulated Date period of completion	when decision is expected	Remarks if any
1	2	3	4	5	6	7

1.6. The following items of equipment are considered essential for successfully carrying out the works. The Tenderer should furnish all the information listed below.

Item of Equipment	Requirement			Owned and available		Remarks
	No.	Capacity	Owned	Number/ Capacity	Age/ Condition	

1.7 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor’s reports for the last five years;

1.8 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.

1.9. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

1.10 Evidence of access to financial resources to meet the qualification requirement specified in ITT Clause3.3 (b): Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

BANKER'S CERTIFICATE

This is to certify that M/s. ..... is a reputed company with a good financial standing. If the contract for this work, namely ..... (name of the work) is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs. ..... to meet the working capital requirements for executing the above contract

Sd/-
Name of the Bank, Senior Bank Manger
Address:.....

1.11 Proposals for subcontracting components of works amounting to more than 20% of the contract price.

Item of Work	Value of Sub-Contract	Identified Sub-Contractor (Name and address)	Experience of similar work

1.12 Information on litigations in which the Tenderer is involved:

Other Party	Employ	Details of	Amount	Remarks showing

(ies)	er	dispute	involved	present status

1.13 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

SECTION 4:

FORMS OF TENDER, LETTER OF ACEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

(Tenderer shall down load this page, print on the letter head, fill the gaps with signature scan the sheet and upload to the website. Failing which the tender will be treated as non responsive)

Description of the Work: Tender for the Work of Comprehensive operation and maintenance of RO plants based on the revenue sharing method coming under AEE(BW&PS)-1-2 subdivision (O&M-3- Total no-56).

To
The Chief Engineer (Design & QA)
Bangalore Water Supply & Sewerage Board
9th Floor, Cauvery Bhavan D-Block,
K.G. Road, Bangalore 560009

Sir/Madam,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender for the Contract Price uploaded for this tender to be opened after qualification.

This Tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely “Prevention of Corruption Act 1988”.

We hereby confirm that this Tender complies with the Tender validity and Earnest money deposit required by the Tender documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory:

_____
Name of Tenderer _____
Address: ----------

Letter of Acceptance
(letterhead paper of the Employer)

_____[date]

To: _____[name and address of the Contractor]

Dear Sirs,

This is to notify you that your Tender dated _____ for execution of the _____[name of the contract and identification number, as given in the Instructions to Tenderers] for the Contract Price of Rupees _____ —— _____ (_____) [amount in words and figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by our Agency.

You are hereby requested to furnish Security deposit plus additional security for unbalanced tenders in terms of Clause 25.5 of ITT, in the form detailed in Clause 29.1 of ITT for an amount of Rs.———— within 20 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to ..... and sign the contract, failing which action as stated in Para 29.4 of ITT will be taken.

Yours faithfully,

Authorized Signature
Name and Title of Signatory
Name of Agency

Issue of Notice to proceed with the work
(letterhead of the Employer)

———— (date)

To
————————————— (name and address of the Contractor)
————————————
————————————

Dear Sirs:

Pursuant to your furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement for the construction of ————[name of the contract] a Tender Price of Rs.————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Agreement Form
Agreement

This agreement, made the _____day of _____20_____, between_____ _____[name and address of Employer] (hereinafter called "the Employer") of the one part and _____ _____ _____ __ _____[name and address of contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute _____ _____ _____ _____[name and identification number of Contract] (hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of Rupees.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be n

2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.

3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

4. Jurisdiction of Courts/Arbitration: The Sitting of arbitration shall be held at Bangalore only and nowhere else.

5. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore city only and the parties agree and clearly understand that the courts/ tribunals situated at Bangalore Metropolitan City have exclusive jurisdiction for the redressal of the disputes arising out of the contract and at no other place.
6. The parties further agree and understand that the place or places of issue of bank guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relating to enforcement of the bank guarantees submitted by the contractor at Bangalore for the execution of the contract at Bangalore.
7. The contractor shall comply with all the legal requirements in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place of conditions during the execution of the contract.
8. Contractor shall be fully responsible in the event of death of employee/ workman during the execution of the work and liable to pay adequate compensation to the dependants of employee/ workman as per law.

9. On his/ their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amounts due to the contractor or by appropriate legal action.
10. If death of any employees occur during execution of work due to negligence of contractor, the contract will be liable for termination.
11. In case of any death or accident the contract will be cancelled after following due process.
12. In event of such termination, the employer may consider blacklisting of firm after due notice.
13. The board will be entitled to claim exemplary damages from the contractor in case of death of any work man/ employees of the contractor in any of the BWSSB works as it damages the reputation of the Board.
14. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
    i) Letter of Acceptance;
    ii) Notice to proceed with the works;
    iii) Contractor's Tender;
    iv) Contract Data;
    v) Conditions of contract (including Special Conditions of Contract);
    vi) Specifications;
    vii) Drawings;
    viii) Bill of Quantities; and
    ix) Any other document listed in the Contract Data as forming part of the contract.

In witness whereof the parties thereto have caused this Agreement to be executed the on ……

The Common Seal of _____
was hereunto affixed in the presence of:
Signed, Sealed and Delivered by the said

_____

_____

in the presence of:

Binding Signature of Employer

Binding Signature of Contractor

SECTION 5: CONDITIONS OF CONTRACT

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Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Tender to carry out the Works has been accepted by the Employer.

The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.

The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects liability period** is the period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the party who will employ the Contractor to carry out the Works.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

A **Variation** is an instruction given by the Employer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor's Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor .

5. Delegation

5.1 The Employer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 The Contractor may subcontract with the approval of the Employer but may not assign the Contract without the approval of the Employer in writing. Subcontracting does not alter the Contractor's obligations.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor’s staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer’s and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer’s risks, and the Contractor carries the risks which this Contract states are Contractor’s risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are:

(a) rebellion, riot commotion or disorder unless solely restricted to employees of the Contractor or his Sub-Contractors arising from the conduct of the Works; or

(b) a cause due solely to the Design & QA of the Works, other than the Contractor’s Design & QA; or

(c) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen; or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;

(A) prevent loss or damage to physical property from occurring by taking appropriate measures or

(B) insure against such loss or damage

12. Contractor’s risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance:

13.1 The Contractor shall prior to commencing the works, effect and thereafter maintain insurances , in the joint names of the Employer and the Contractor, (cover from the first working day after the Start Date to the end of Defects Liability Period), in the amounts stated in the Contract Data :

(a) for loss of or damage to the Works, Plants and Materials and the Contractor's equipment;

(b) for liability of both Parties for loss, damage, death and injury to third parties or their property arising out of the Contractor's performance of the Contract including the Contractor's liability for damage to the Employer's property other than the Works and

(c) for liability of both Parties and of any Employer's representative for death and injury to the Contractor's personnel except to the extent that liability arises from the negligence of the Employer, any Employer's representative or their Employees.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Employer for his approval before the Start Date. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred. All payments received from insurers relating to loss or damage shall be held jointly by the Parties and used for the repair of the loss or damage or as compensation for loss or damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the insurances referred to in the previous sub-clauses or fails to provide satisfactory evidence, policies or receipts, the Employer may without prejudice to any other right or remedy, effect insurance for the cover relevant to such default and pay the premiums due and recover the same as a deduction from any other monies due to the Contractor. If no payments is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of an insurance shall not be made without the approval of the Employer.

13.5 Both Parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports:

14.1 The Contractor, in preparing the tender, shall rely on any site investigation reports referred to in the Contract data, supplemented by any information available to the Tenderer.

15. Queries about the Contract Data

15.1 The Employer will clarify queries on the Contract Data.

16. Contractor to construct the Works

16.1 The Contractor shall Operation and Maintenance works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

18. Approval by the Employer:

18.1 The Contractor shall submit Specification and drawings showing the proposed Temporary Works to the Employer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for the Design & QA of Temporary Works

18.3 The Employer’s approval shall not alter the Contractor’s responsibility for Design & QA of the Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the Design & QA of third parties to the Design & QA of the temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Employer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

24. Procedure for resolution of Disputes:

24.1 If the Contractor is not satisfied with the decision taken by the Employer, the dispute shall be referred by either party to Arbitration within 30 days of the notification of the Employer’s decision.

24.2 If neither party refers the dispute to Arbitration within the above 30 days, the Employer’s decision will be final and binding.

24.3 The Arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

B. Time Control

25. Program

25.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

28. Management meetings

28.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

28.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

C. Quality Control

29. Identifying defects

29.1 The Employer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any work that the Employer considers may have a Defect

30. Tests

30.1 If the Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31. Correction of defects

31.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Employer’s notice.

32. Uncorrected defects

32.1 If the Contractor has not corrected a Defect within the time specified in the Employer's notice, the Employer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. Cost Control

33. Bill of Quantities (BOQ)

33.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

33.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item

34. Variations

34.1 Deleted

34.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract.

34.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawings.

34.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and if no such confirmation is received within 15days of request, it shall be deemed to be an order in writing by the Employer.

35. Payments for Variations

35.1 Deleted

36. Submission of bills for payment

36.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

36.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

36.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

37. Payments

37.1 Payments shall be adjusted for deductions for advance payments, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the within **60 days** of submission of bill. The Contractor shall be liable to pay liquidated damages for shortfall in progress. For Progress beyond the agreed Programme, payment is subject to availability of the grants.

37.2 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

38. Compensation events

38.1 The following are Compensation events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.
(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.
(c) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.
(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
(e) The effect on the Contractor of any of the Employer's Risks.
(f) The Employer unreasonably delays issuing a Certificate of Completion.
(g) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

38.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

38.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer's own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

38.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

39. Tax

39.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

40. Price Adjustment:

40.1 Deleted

40.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

41. Liquidated damages

41.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the

milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

41.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

42. Advance Payments:

42.1 Deleted

43. Securities:

43.1 The Security deposit (including additional security for unbalanced tenders) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and type of instrument acceptable to the Employer. The Security deposit shall be valid until a date 30 days from the date of expiry of Defects Liability Period and the additional security for unbalanced tenders shall be valid until a date 30 days from the date of issue of the certificate of completion.

44. Cost of Repairs:

44.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

46.1 The Employer shall take over the Site and the Works within seven days of issuing a certificate of Completion.

47. Final account

47.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor’s revised account.

48. As built drawings and /or Operating and Maintenance Manuals

48.1 If “as built”[1]Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer’s approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

49. Termination

49.1 The Employer may terminate the Contract if the other party causes a fundamental breach of the Contract.

49.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 7 days as and when no work is shown on the current Program and the stoppage has not been authorized by the Employer;

(b) the Employer instructs the Contractor to delay the progress of works and the instruction is not withdrawn within 60 days;

(c) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(d) a payment due to the Contractor is not paid by the Employer within 90 days of the date of the submission of the bill by the Contractor.

(e) the Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;

(f) the Contractor does not maintain a security which is required;

(g) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(h) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract. For the purpose of this paragraph : “corrupt practice” means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. “Fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) Design & QAed to establish Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.”

49.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub Clause 49.2 above, the Employer shall decide whether the breach is fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

[1]Completion Drawings

49.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

50.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare bill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

51. Property

51.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor’s default.

52. Release from performance

52.1 If the Contract is frustrated by any event entirely outside the control of either the Employer or the Contractor the Employer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made

F. Special Conditions of Contract

1. Labour:

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Employer, deliver to the Employer a return in detail, in such form and at such intervals as the Employer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Employer may require.

2. Compliance with labour regulations:

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

3. Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

4. Arbitration (Clause 24)

4.1 The procedure for arbitration shall be as follows:

(a) In case of dispute or difference arising between the Employer and the Contractor relating to any matter arising out of or connected with

this agreement it shall be settled in accordance with the Arbitration and Conciliation Act 1996. The disputes or differences shall be referred to a Sole Arbitrator. The Sole Arbitrator shall be appointed by agreement between the parties; failing such agreement, by the Appointing Authority (any one of the Organizations as per list enclosed in Annexure)

(b) Arbitration proceedings shall be held at ***Bangalore***, Karnataka, India

(c) The cost and expenses of arbitration proceedings will be paid as determined by the Arbitrator. However the expenses incurred by each party in connection with the preparation, presentation, etc., shall be borne by each party itself.

(d) Performance under the contract shall continue during the arbitration proceedings and payments due the Contractor by the Employer shall not be withheld, unless they are the subject matter of the arbitration proceedings.

5 Contractor to Co-ordinate his Work with Other Contractors

5.1 The Contractor has to co-ordinate with the other concerned Contractors as already specified in Conditions of Contract for all such works as per the directions of Engineer in charge at no extra cost.

6 **Continuation of Work:**

6.1 In case of the death of a contractor after executing the agreement / commencement of the work, his legal heir, if any eligible registered contractor and willing, can execute and complete the work at the accepted tender rates irrespective of the cost of the work

7. Minimum stock of materials must be maintained to attend emergency works during Guarantee period.

8. No illegal activities like encouraging to unauthorized connections, cash collection from public, misbehaving etc., are permitted. If noticed action will be taken to terminate the contract without notice forfeiting the dues payable to the firm.

SECTION 6:

CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract: Clause Reference

- The Schedule of Operating and Maintenance Manuals [48]
- The Methodology and Program of Construction [25]
- Site Investigation Reports [14]

The Employer is:
Name: Bangalore Water Supply and Sewerage Board represented by Chief Engineer (Design & QA) [1.1]

Address: Bangalore Water Supply & Sewerage Board
9th Floor, Cauvery Bhavan D-Block,
K.G. Road, Bangalore 560009

Name of authorized Representative: Executive Engineer (Borewell)
Bangalore Water Supply & Sewerage Board

[1.1]

The name and identification number of the Contract is :	Tender for the Work of Comprehensive operation and maintenance of RO plants based on the revenue sharing method coming under AEE(BW&PS)-1-2 subdivision (O&M-3- Total no-56).

The start date shall be the date of issue of notice to proceed with the work. [1.1]

The Intended Completion Date for the whole of the Works is **24 Months**

The Site possession date is **immediately** from the day of issue of notice to proceed with the work

The Site location will be informed by the Engineer-in-charge.
[1.1]

After completion of O & M period, RO Plants should be handed over in workable condition.
[31]

Insurance requirements are as under: [13]

Type of Cover	Minimum Cover for Insurance

(i)	Works and of Plant and materials	The sum stated in the Agreement plus 20%
(ii)	Loss or damage to equipment	Full replacement cost
(iii)	Loss or damage to property of Third Party	Full replacement cost
(iv)	Personal injury or death insurance (a) for Third Party	Rs. 20.00 Lakh
	(b) for Contractor's employees or labour	In accordance with the statutory requirements applicable to Karnataka

Price Adjustment Formula: NOT APPLICABLE [40]

The liquidated damages for the whole of the works are Rs. ***0.1%*** per day of the contract value.

The maximum amount of liquidated damages for the whole of the works is ***ten*** percent of final contract price. [41]

[48]

The following events shall also be fundamental breach of the contract : [49.2]

1. The contractor has contravened Sub-clause 7.1 and Clause 9 of CC.

The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be ***30*** percent. [50.1]

Payment Terms and Conditions: On revenue sharing method

1. **The revenue generated from each individual RO plant will be automatically deposited to BWSSB account via QR code.**
2. **As per the highest quoted rate, then it will be converted to percentage of the total revenue retained by the BWSSB.[Minimum rate quoted in the estimate is 40% of the average revenue generated per RO plant].The remaining percentage of the amount will be released to O&M Contractor as per the actual revenue generated per RO plant in the package.**

NOTE: It is recommended to clarify the payment terms in the pre-biddingmeeting.

SECTION 7:

TECHNICAL SPECIFICATIONS

IS 16240 : 2023 Indian Standard

REVERSE OSMOSIS BASED POINT OF USE WATER TREATMENT SYSTEM FOR DRINKING PURPOSES — SPECIFICATION

1 SCOPE

1.1 This standard covers reverse osmosis (RO) based point-of-use (PoU) water treatment system with a product water capacity of up to 50 litre per hour, that reduces total dissolved solids (TDS); and physical, chemical, and microbiological contaminants from specified concentrations in the

feed water to the maximum allowable limits in the product water.

1.2 The standard does not cover requirements for consumables, such as filters and treatment media.

2 REFERENCES

The standards listed below contain provisions, which, through reference in this text, constitute

provisions of this standard. At the time of publication, the editions indicated were valid. All

standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

TS No. Title IS 302 (Part 1): Safety of household and 2008 similar electrical

appliances: Part 1 General requirements (sixth revision)

IS 3025 Method of sampling and test (physical and chemical) for water and wastewater:

(Part 16) : 2023 Filterable residue (total dissolved solids) at 180 °C (second revision)

(Part 34) : 1988

(Part 37) : 2022

(Part 41) : 1992

(Part 42) : 1992

(Part 47) : 1994

(Part 48) : 1994

(Part 52) : 2003 Chromium(first revision)

(Part 60/Sec 1) : Fluoride (second

2023 revision)

Nitrogen (first revision)

Arsenic (second revision)

Cadmium (first revision)

Copper (first revision)

Lead (first revision)

Mercury (first revision)

IS No. Title

IS 4905 : 2015 Random sampling and randomization

procedures (first revision)

IS 9845 : 1998 Determination of overall migration of constituents of plastics materials and articles intended to come in contact with foodstuffs — Method of analysis

(second revision)

IS 10500 Drinking water — 2012 Specification (second revision)

IS 15185 : Water quality — 2016 Detection and enumeration of Escherichia coli and coliform bacteria — Membrane filtration method for water with low bacterial background flora (first revision)

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Chemical Reduction — A reduction in the concentration of one or more specified organic or

inorganic chemical contaminants by a system from feed water.

3.2 Contaminant — An undesirable physical, chemical, or microbiological substance or parameter in water that may have adverse effects on health or aesthetics, or both.

3.3 Drinking Water — Water from any source which is intended for human consumption, both

drinking and cooking purposes (see IS 10500).

3.4 Feed Water — Water entering the system, which is to be treated by the system.

3.5 Influent Challenge Water — The standard test water with specified contaminants entering a system for evaluation.

3.6 Permeate — The portion of feed water that has been treated by passage through the RO membrane.

3.7 Point-of-Use (PoU) Drinking Water Treatment System — A plumbed-in or faucet-

mounted system used to treat the feed water for direct consumption or use, hereinafter referred to as ‘system’.

NOTE — PoU RO systems are not intended for distribution.

3.8 Production Rate — The volume of water produced by a system in litres per hour (lph).

3.9 Product Water — Water that has been treated by the system.

3.10 Recovery Rating — The ratio of product water to feed water, expressed as a percentage.

3.11 Reject Water — The portion of the feed water that is not converted to product water. It is also called the concentrate, as the solutes (contaminants) are concentrated in the reject water stream.

3.12 Reverse Osmosis (RO) — A pressure-driven membrane separation technique to reduce the

concentration of dissolved solutes such as minerals, salts and organic species in water. Reverse osmosis uses an applied pressure to drive the transport of water across a semi-permeable membrane from a more concentrated solution (feed) to a more dilute solution (permeate).

NOTE — RO is often used in commercial and residential water treatment. It is also one of the methods used for the desalination of brackish water and seawater. In RO-based systems, typically, a spiral wound membrane element is used along with pretreatment filters consisting of sediment filters, activated carbon filters, etc.

3.13 RO Membrane — A semi-permeable barrier that allows the preferential passage of water.

Commonly used reverse osmosis (RO) membranes include cellulose triacetate and aromatic polyamide polymers, popularly known as TFC (thin film composites).

4 CONSTRUCTION

4.1 Inlet Port

The system’s inlet port shall be so designed that it can be suitably connected to the feed water source.

4.2 Method of Mounting

The system shall facilitate wall-mounting, countertop placement, or under-the-sink installation,

etc.

4.3 Main Components

4.3.1 The RO system shall have the following components:

a) Sediment Filter — A filter required to remove physical impurities in the form of

suspended solids like dust, dirt, silt and other fine particles from the feed water;

b) Adsorption Media — Required for the removal of chlorine and organic matter from

water;

c) Reverse Osmosis Membrane Element — Should be able to reduce TDS, comprising

of dissolved inorganic and organic contaminants;

d) Booster Pump — Should be able to provide the required operating pressure based on the

RO membrane used;

e) Reject Water Control Mechanism — Required to control the reject water flow, thereby controlling the recovery rating or/and pressure;

f) Power Supply;

g) Auto Shut-off Mechanism — Required to prevent overflow and dry running of the pump; and

h) TDS Display Meter — Required to display

the TDS value (mg/litre) of feed water and

product water within a tolerance of + 10% of

TDS when tested as per IS 3025 part 16.

NOTES

1 If the system does not have an inbuilt/integrated TDS Display meter, the manufacturer shall provide hand held TDS meter with digital display, as an accessory along with

the system. IOT enabled TDS display method may also be provided as an option.

2 The functioning of the TDS meter shall be ascertained periodically by the maintenance service provider and explicit instructions for calibration and maintenance of the

TDS meter shall be provided by the manufacturer in the user manual.

4.3.2 The RO system may have the following additional components (non-exhaustive list):

a) Flushing Mechanism;

b) Ultraviolet (UV) Disinfection Chamber/In

Tank Sanitization;

c) Ultrafiltration (UF) Membrane;

d) TDS Control Valve — A valve that splits the feed flow into two streams, one passing

through the RO membrane and the second through an RO by-passing line. A blend of

RO permeate flow and bypass flow yields

product water; and

e) The following post-membrane components/treatments may be incorporated:

1) Mineraliser/Taste Enhancer Media — Required to improve the taste of RO treated

water; and

2) Activated Carbon Media.

NOTE — For systems where mineraliser/taste enhancer media is used, the manufacturer shall declare that the mineraliser/taste enhancer media being used will not cause any of the parameters in product water to exceed acceptable limits specified in IS 10500.

5 MATERIALS

5.1 Materials in contact with water shall comply with the overall migration limits of 60 mg/litre, Max for various plastic materials when tested by the method prescribed in IS 9845.

5.2 Materials of Construction

5.2.1 Those surfaces of the components of the RO system, which are expected to get wetted by the flow of water through the RO system, shall be made of corrosion-resistant materials or shall have corrosion- resistant treatment or coating of food-grade quality.

The manufacturer shall provide evidence of the same.

5.3 Membrane Preservatives

5.3.1 The chemical preservatives used in the membrane shall be of food-grade quality and shall

be declared by the manufacturer in the user guide for consumers.

5.3.2 The manufacturer shall also declare the flushing requirement at the time of installation, in

the user guide.

6 PERFORMANCE REQUIREMENTS

6.1 General

The RO system shall be so designed and constructed that its intended purpose is accomplished when installed and operated in accordance with the manufacturer’s instructions.

6.2 Reject Water Control Mechanism

6.2.1 A reject water control mechanism (flow restrictor) shall be provided as an integral part of the system to regulate the flow of reject water. The performance of the system (recovery rating)

depends on the specified reject water flow rate.

6.3 Performance

6.3.1 TDS Reduction

6.3.1.1 The system shall reduce the TDS level of feed water to less than or equal to 500 mg/litre in the product water, as per the maximum desirable concentration specified in IS 10500, when tested as per IS 3025 (Part 16).

6.3.1.2 The influent challenge water for TDS reduction testing shall have minimum | 500 mg/litre

of TDS or the maximum operating TDS level as declared by the manufacturer, whichever is higher.

6.3.1.3 The method of testing TDS reduction is given in Annex A.

6.3.2 Chemical Reduction

6.3.2.1 The system shall meet the maximum allowable product water levels as given in Table 1.

6.3.2.2 The method of testing chemical reduction is given in Annex B.

6.3.3 Microbiological Reduction

6.3.3.1 The manufacturer shall meet the requirements of Table | to deliver microbiologically

safe drinking water. The method of testing microbiological (bacteriological and virological)

reduction is as given in Annex C.

6.3.3.2 Optional requirements for microbiological reduction

6.3.3.2.1 The requirements given in Table 2 shall be optional requirements which shall be tested for the RO system as per Annex D by manufacturers claiming their reduction. These requirements shall be mandatorily tested in case, the system has a TDS control mechanism employing RO-bypass blending.

6.4 Percent Recovery of Product Water and

Hourly Production Rate

6.4.1 The minimum recovery rate shall be equal to or more than 40 percent.

6.4.2 Production rate shall not be less than 5 litre per hour.

6.4.3 The method for evaluating recovery rating and hourly production rate is as prescribed in Annex A.

6.4.4 The manufacture shall declare:

a) Recovery rating;

b) Maximum operatable feed water TDS;

d) Production rate, in Iph; and

e) Operating pressure range, in MPa or psi.

Table 1 Chemicals and Microbiological Reduction

(Clauses 6.3.2.1, 6.3.3.1 and B-1.2)

SI No. Contaminant Influent Challenge Maximum Allowable Method of Testing Level Product Water Level

(1) (2) (3) (4) (5)

i) Arsenic (as As), mg/litre 0.10+ 10% 0.01 IS 3025 (Part 37)

il) Cadmium (as Cd), mg/litre 0.03 + 10% 0.003 IS 3025 (Part 41)

ili) Chromium (as Cr), mg/litre 0.30+ 10% 0.05 IS 3025 (Part 52)

iv) Copper (as Cu), mg/litre 3.00+ 10% 1.0 IS 3025 (Part 42)

v) Fluoride (as F), mg/litre 8.00 + 10 % 1.0 IS 3025 (Part 60)

vi) Lead (as Pb), mg/litre 0.15 10 Yo 0.01 IS 3025 (Part 47)
vil) Mercury (as Hg), mg/litre 0.006 + 10% 0.001 IS 3025 (Part 48)
viii) Nitrate (as NO3), mg/litre 150.00 + 10 % 45 IS 3025 (Part 34)

ix) Pesticides total ug/litre 0.3 of each pesticide 0.1 (of each pesticide) IS 10500

0.5 (total pesticides) x) E. coli 1.0 x 107 cfu/100 ml to 99.9999 percent reduction IS 15185

1.0 x 10% cfu/100 ml (LRV 6)

x1) MS-2 Coliphage (Virus) 1.0 x 10* pfu/ ml to 99.99 percent reduction Annex B of IS 10500or L0 x 10° pm (RV 4) Manual of Method for Virology Chapter 16, June 2001 NOTES

1 Method for testing chemical reduction is given in Annex B wherein the preparation of influent challenge water is also prescribed for the test. The

testing protocol given in Annex B is to be followed along with methods of test indicated in col (5) of Table 1 for specific contaminants.

2 Method for testing microbiological reduction (for E. coli and MS-2 Coliphage) is given in Annex C wherein the preparation of influent challenge water is also prescribed for the test. The testing protocol given in Annex C is to be followed along with methods of test indicated in col (5) of Table 1 for specific contaminants

3 For the estimation of contaminants given at SI No. (i) to (viii) approved and validated international test methods from

ISO/APHA/ASTM/AOAC/EPA/EN may also be followed.

Table 2 Optional Requirements for Microbiological Reduction

(Clause 6.3.3.2.1)

SI No. Contaminant Influent Challenge Minimum Percent Method of Testing, Ref to Level Reduction Required

(1) (2) (3) (4) (5)

i) Cryptosporidium parvum > §x107/100 ml 99.9 percent (LRV 3) Annex D

ii) Giardia lamblia > 5x10°/100 ml 99.9 percent (LRV 3) Annex D

NOTES

1 Claims for above microbiological reduction shall be made for the specific contaminants shown in this table. To qualify for a specific contaminant

reduction claim, the system shall reduce the level of the contaminant from the influent challenge to the specified limits.

2 LRV- Log reduction value.

3 Annex D prescribes two alternative methods for evaluating the reduction of specified protozoans. The method given in D-1 shall be the referee

method in case of dispute, and either of the methods D-1 or D-2 shall be the routine method of testing.

6.5 Electrical Safety

6.5.1 The system shall not have excessive leakage current when tested in accordance with 13 of

IS 302 (Part 1).

6.5.2 The system shall be able to withstand high voltage test when tested in accordance with 13 of IS 302 (Part 1).

6.5.3 The system shall have provision for earthing in accordance with 27.5 of IS 302 (Part 1). All parts of metallic construction shall be permanently and reliably connected to an earthing termination within the RO system and shall be free of rough or sharp edges or other hazards that may cause injury to persons adjusting, servicing, or using the system.

NOTE — Class II appliances and Class III appliances shall have no provision of earthing.

6.6 Power supply

The system shall work on electrical supply upto and including 250 V, 50 Hz for single phase & upto and including 440 V, 50 Hz for three phase supply.

6.7 Pressure Test (Hydrostatic Test) — Type Test

All the components of the RO system through which the water passes shall pass the hydrostatic test as prescribed in Annex E.

6.8 Routine Pressure Test (Pneumatic Test)

6.8.1 Minimum 5 percent of the units of RO system produced per batch shall be tested by a routine pneumatic test.

6.8.2 Full Device Leakage Testing

Compressed air (at a pressure 0.2 MPa) is fed through the inlet point of the device keeping all the

outlets shut. After the pressure reaches the maximum, the airline is isolated by a manual valve

and checked for a drop in pressure over a period of 3 min. If the pressure is sustained, then this is found to be free from any leak.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Take samples (test systems) as per the sampling plan given in Annex F.

7.2 Test as per the sequence given in Annex F.

7.3 All tested systems should pass in all the requirements. In case of any failure, discontinue further testing.

8 MAINTENANCE OF THE PRODUCT

8.1 RO system contains a replaceable treatment component critical for effective reduction of total

dissolved solids. The product water shall be tested periodically by the maintenance service provider to verify the system performance after replacement of consumables as specified by the manufacturer.

8.2 For all filtration components like sediment filter, activated carbon filter and RO membrane filter, manufacturer shall declare the maximum possible life in terms of liters of water, which can be processed through each filter. Factors affecting the performance of the filters shall be mentioned. All this information shall be provided in the user manual.

8.3 The manufacturer shall give explicit instructions in the user manual and also on the product for cleaning and disinfecting of the storage tank by halogenated solutions (usually chlorine) or any other equivalent disinfection methods. The

recommended frequency shall also be mentioned in the user manual. This would help in prevention and control of biofilm formation in the storage tank.

9 PACKING

The RO system shall be suitably packed in order to avoid damage during transit and storage.

10 MARKING

10.1 The system shall be affixed with a conformance label meeting the following requirements, namely:

a) The label shall be durable and all the markings shall be legible and indelible; and

b) The label shall be affixed on a part necessary for normal operation of the product and not

normally requiring replacement during the life of the product.

10.2 The label shall be marked with the following details:

a) Name and address of the manufacturer or assembler of product, as the case may be;

b) Model name or code;

c) Production serial number;

d) Date of manufacture of product;

e) Rated recovery efficiency and

corresponding water reject generation;

f) Production rate in litres/h;

g) Maximum operating TDS level;

h) Supply voltage whether single or three- phase, frequency, volts and wattage; and

j) Any other requirement as given under the Environment (Protection) Rules, 1986.

10.3 The manufacturer shall explicitly state the following caution on the label of the RO system:

‘RO system is not recommended for arsenic level above 0.1 mg/litre, fluoride level above 8.0 mg/litre and iron level above 0.3 mg/litre’.

10.4 A user manual for the proper method of operation and use of the RO system shall be supplied along with the RO system. It shall also include the specifications and life/replacement frequency of all the filters/consumables.

10.5 The manufacturer shall provide a suitable warranty for the RO system.

10.6 BIS Certification Marking

10.6.1 The product may also be marked with the BIS

Standard Mark.

10.6.2 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations framed thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Clauses 6.3.1.3 and 6.4.3)

EVALUATION OF TDS REDUCTION, RECOVERY RATING AND HOURLY PRODUCTION RATE

A-1 TDS REDUCTION TESTING

A-1.1 TDS reduction testing may be done prior to, or with inorganic contaminants reduction testing described in B-1.

A-1.2 To prepare the influent challenge water for TDS reduction testing, sodium chloride (NaCl) shall be added to chlorine-free deionized water (Turbidity < 1 NTU, pH 7.5 + 0.5, Conductivity < 1 wS/cm, Temperature 25 °C), to achieve the required challenge concentration (+ 10 Yo).

A-1.3 Method of Testing

Two fresh systems shall be used for TDS reduction testing.

Install and condition the new RO system as per the manufacturer’s instructions. After flushing with tap water (TDS < 500 mg/l, Turbidity < 1 NTU, pH 7.5 + 0.5, Iron < 0.3 mg/l), connect the system to the TDS influent challenge water feed at the maximum recommended inlet pressure. Before the initial sampling, allow at least 10 litres of product water to filter and drain away with the storage tank’s dispensing tap open. Then close the storage tank tap and allow the tank to fill until automatic cut- off. Collect water samples in duplicate from the influent challenge

water tank and the product water storage tank and analyse for TDS as per IS 3025 (Part 16).

In case of direct flow models (where no storage tank is provided), allow 10 litres of product water to flow before collecting water samples and test as per IS 3025 (Part 16).

A-1.4 If the system has a TDS control mechanism employing RO-bypass blending, TDS reduction testing will be done with the TDS control valve in full-open position (maximum flow in the bypass line).

A-2 RECOVERY RATING AND HOURLY PRODUCTION RATE

A-2.1 Recovery rating and hourly production rate may be evaluated along with TDS reduction testing.

A-2.2 Recovery Rating

Connect the system to the TDS influent challenge water feed (prepared as per A-1.2) at the maximum recommended inlet pressure, and allow the system to operate until the flows of product and reject water have stabilized. (If a storage tank is present, operatewith the storage tank’s dispensing tap open.) After the stabilization of flows, collect product water and the corresponding volume of reject water for one hour of system operation. The volume of product and reject water collected shall be recorded in litres.

The recovery rating shall be calculated using the following formula:

Vow ————~ x 100

(Vew + Vrjw)

Recovery rating (%) =

where

Vpw = volume of product water generated in 1 h of operation (litres); and

Vrjw = corresponding volume of reject water generated (litres)

NOTE — If the system has a TDS control mechanism employing RO-bypass blending, recovery rating shall be determined with the TDS control valve in full-closed position.

A-2.3 After collecting the samples for recovery testing, allow the system to operate for 2 continuous hours and record the volume of product water collected. Hourly production rate is calculated as follows:

Hourly production rate (litres/hour) = Volume of water collected in litres/hour

ANNEX B

(Clause 6.3.2.2 and Table 1)

EVALUATION OF CHEMICAL REDUCTION

B-1 INORGANIC CONTAMINANTS

Inorganic contaminants reduction testing may be done with or subsequent to TDS reduction testing described in Annex A.

B-1.1 Two test systems shall be evaluated. Prepare 100 litres of influent challenge water for inorganic contaminant reduction testing, as follows:

Prepare TDS reduction test water as per A-1.2. The influent challenge levels specified in Table 1

may be achieved by adding salts in the amounts specified in Table 3. Using NaCl, adjust the final

TDS of the influent challenge water to the required TDS challenge level (1 500 mg/litre or

the maximum TDS claimed by the manufacturer + 10 percent).

B-1.2 Method of Testing

The systems previously used for TDS reduction testing may be used for inorganic chemicals

reduction testing. After flushing with tap water (TDS < 500 me/litre, Turbidity < 1 NTU,

pH7.5 +0.5, Iron < 0.3 mg/litre), connect the system tto influent challenge water feed at the maximum recommended inlet pressure and allow at least 10 litres of product water to filter and drain away with the storage tank tap open. Then close the storage tank tap and allow the storage tank to fill until automatic cut-off. Collect water samples in duplicates from the influent challenge water tank and the product water storage tank and analyse for the various chemical contaminants as per applicable parts IS 3025 as indicated in Table 1. In case of direct flow models (where no storage tank is provided), allow 10 litres of product water to flow before collecting water samples and test as per the applicable parts of IS 3025.

B-2 PESTICIDES

B-2.1 The influent challenge water for testing pesticide reduction shall be prepared by adding

NaCl to deionized water, adjusting TDS in the 250 mg/litre to 300 mg/litre range. Adjust pH in the 7.5 + 0.5 range by adding dilute HCl or NaOH solution as

required. To this add appropriate amount of each pesticide solution (in methanol) to yield 0.3 ug/litre concentration of each pesticide.

Table 3 Composition of Inorganic Contaminants Influent Challenge Water

(Clause B-1.1)

SINo. Contaminant Influent Challenge Compound Weight of Compound

Level in 100 litres Solution

(1) (2) (3) (4) (5)

i) Arsenic as As (V) 0.1 mg/litre Naz2HAsOq4.7H20 41.7 mg

ii) Cadmium as Cd 0.03 mg/litre CdCl; anhydrous 4.9 mg

or

6.3

Cd(NO3)2 anhydrous ne

ili) Total Chromium as Cr 0.3 mg/litre CrCl3.6H20 77 mg

(III) and Cr (VI) [0.15 mg/litre each of and 86

CrM) and Cr(vD] NaoCr207.2H»O0 mg

iv) Copper as Cu 3 mg/litre CuSO4.5H20 1.18 g

v) Fluoride as F 8 mg/litre NaF 1.77 g

vi) Lead as Pb 0.15 mg/litre PbCl2 20.1 mg

or Pb(NO;)2 24.0 mg

vii) Mercury as Hg 0.006 mg/litre HeCl, 0.81 mg

viii) Nitrate as NO3 150 mg/litre NaNO; 20.6 g

B-2.2 Method of Testing

To the system previously used for inorganic chemicals reduction testing, connect influent challenge water prepared in B-2.1, but without pesticides added, and flush until 10 litres product

water is produced. Then connect the system to pesticides influent challenge water at the maximum recommended inlet pressure and allow at least 10 litres of product water to filter and drain away with the storage tank tap open. Then close the storage tank tap and allow the product water to be collected in the tank until automatic cut-off. Collect water samples in duplicate from the influent challenge water tank and the product water storage tank and analyse for the various

pesticides as per IS 10500.

In case of direct flow models (where no storage tank is provided), allow 10 litres of product water to flow before collecting water samples and test as per IS 10500.

B-3 If the system has a TDS control mechanism employing RO-bypass blending, all chemical

reduction testing will be done with the TDS control valve in full-open position (maximum flow in the bypass line).

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ANNEX C

(Clause 6.3.3.1 and Table 1)

EVALUATION OF MICROBIOLOGICAL REDUCTION

C-1 Two fresh systems shall be used for microbiological reduction testing. Bacterial

reduction testing shall be done followed by viral reduction testing in the same RO system as per the sampling plan given in Annex F.

C-2 GENERAL TEST WATER

A chlorine free general test water with the following characteristics shall be used:

a) pH-7.5+0.5;

b) Turbidity < 1 NTU;

c) TDS — 400 mg/litre to 500 mg/litre (adjust using NaCl);

d) Iron < 0.3 mg/litre; and

e) Temperature (25 + 5) °C

A public tap water supply may be used. TDS may be adjusted by addition of NaCl (to raise TDS) or by diluting with RO treated/deionized water (to lower TDS). pH may be adjusted using dilute HCI or NaOH solution.

C-3 EQUIPMENT AND ACCESSORIES

a) Autoclave;

b) Incubator;

c) Laminar air flow;

d) Vortex mixer;

e) Vacuum pump;

f) pH meter;

g) UV-Vis spectrophotometer;

h) Centrifuge;

j) Refrigerator;

k) Water bath;
m) Colony counter;

n) Membrane filters of 0.45 u;

p) Sterile polycarbonate membrane filters of 0.22 u;

q) Sterile filtration apparatus;

r) Sterile syringes and forceps;

s) Pipettes;

t) Petri dishes;

u) Test tubes 16 mm x 150 mm; and
v) Sterile centrifuge tubes.

C-4 REAGENTS AND MEDIA

a) Sterile Coliform Chromogenic Agar /Sterile MacConkey Agar Medium/M- Endo agar/ Eosin Methylene Blue agar;

b) Tryptic Soy Agar Medium (TSA) - 1.5 percent, pH 7.3. Dissolve TSA by boiling, adjust to final pH, and autoclave at 120 °C and 15 psi for 20 min. Pour the tempered media into sterile Petri dishes. Store the agar plates at 5 °C, but allow to come to room temperature before use;

Phage top Agar - 1% TSA, pH 7.3. Dissolve TSA by boiling, adjust to final pH, and autoclave at 120 °C and 15 psi for 20 min. Agar shall be stored at 5 °C. On the day of testing, liquefy the TSA and place in a 45 °C water bath. The MS-2 Coliphage top agar shall be maintained at 45 °C to prevent agar solidification;

Sterile Tryptic Soy Broth Medium (TSB) Dissolve TSA by boiling and adjust to final

pH. Dispense 8 ml aliquots of TSB into 16 mm x 150 mm test tubes. Autoclave the

tubes at 120 °C at 15 psi for 20 min. Store the cooled broth at 5 °C;

Sterile Saline (0.85 percent);

f) Phosphate-buffered saline (PBS);

Ethylenediamine tetra acetic acid (EDTA); and

h) Lysozyme.

C-5 CHALLENGE ORGANISMS

C-5.1 Bacterial Challenge

Escherichia coli (ATCC # 10536 or MTCC 68).

The level of bacteria in the challenge water should be approximately ~ 5 x 107/100 ml, as a 7 logio concentration is required for determining 6 logio reduction. The quantity of bacteria in a sample is expressed as colony forming units (cfu)/100 ml.

C-5.2 Viral Challenge

MS-2 Coliphage (ATCC #15597-Bl)

Escherichia coli (ATCC #15597) host strain for

MS-2

Coliphage presence in ground water is an indication of faecal contamination. The quantity of Coliphage in a sample is expressed as plaque forming units (pfu)/ml. The procedure of stock culture preparation, preparation of challenge water and quantification of MS-2 Coliphage plaques are given below.

The level of MS-2 Coliphage lysate in the viral challenge water should be about ~ 5 x 10° pfu/ml.

C-6 PREPARATION OF

MICROBIOLOGICAL CHALLENGE WATER

C-6.1 Bacterial Influent Challenge Water

C-6.1.1 Bacterial Stock Culture Preparation

E. coli cultures in stationary growth phase shall be washed and suspended in phosphate-buffered saline before challenge water preparation:

a) E. coli is grown overnight on tryptic soy agar (TSA) slants and checked using MacConkey’s agar or equivalent selective media (M-Endo agar, Eosin Methylene Blue agar) for confirmation;

b) The culture is then transferred to a TSB tube for 15 h to 18 h and incubated at 37 °C;

c) The resultant suspension is subjected to cycles of centrifugation-resuspension in 0.85 percent sterile saline (Eppendorf 3 000 x g for 4 min at room temperature). The bacterial pellet is washed and re suspended in sterile saline (0.85 %) to get OD between 0.8 to 1.0 at à = 600 nm. This

corresponds to a viable count of about 10° cfu/ml; and

d wm

Alternatively, the culture could be recovered from the overnight plate directly in sterile

saline (taking care not to scrape out agar) and the OD adjusted to 0.8 to 1.0 at = 600 nm.

C-6.1.2 To prepare 100 litres challenge water, add appropriate quantities of the bacterial suspension in the general test water described in C-2, for a final bacterial count between 107 ml to 108/100 ml. The actual cell numbers are verified by the counts of colony forming units (cfu).

C-6.2 Viral Influent Challenge Water

C-6.2.1 Viral Stock Culture Preparation

This section describes the propagation and harvesting methods for stock suspensions of MS-2

Coliphage for use as a challenge suspension. The stock preparation procedure may have to be repeated multiple times to achieve the required volume of MS-2 Coliphage challenge water.

a) One day prior to preparation of MS-2 Coliphage stock, thaw a cryogenically frozen E. coli host strain (ATCC #15597). Inoculate one TSB tube with 0.1 ml of the stock suspension and incubate at 37 °C for

15 hto 18h;

b) For preparing MS-2 Coliphage stock, liquefy lpercent TSA and temper the media in a

45 °C water bath. Prepare 1.5 percent TSA plates, which should be at room temperature

prior to use;

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c) Prepare serial dilutions of MS-2 Coliphage suspension in sterile PBS. Plate 10° to 10°

dilutions (1 ml dilution per plate) in triplicate on 1.5% TSA plates. In a sterile

tube, transfer 1 ml of diluted MS-2 Coliphage. Then quickly add 0.1 ml of E.

coli host to ~ 5 ml of melted 1 percent TSA. Vortex to mix inoculum and media and pour

on the 1.5 percent TSA basal plates, with rocking to spread the inoculum evenly. After the 1 percent TSA layer has solidified, the plates shall be inverted and incubated at

37 °C for 15 h to 18 h;

d

Na

Select the plates that show complete lysis of host bacterial cells by the MS-2 Coliphage.

Flood the surface of each plate with 3 ml of TSB, and remove the 1 percent TSA layer

gently using a cell scraper. Pour the contents into two sterile 50 ml centrifuge tubes and

make up the total volume to 40 ml with TSB. Add 0.2 g EDTA and 0.026 g lysozyme to

each tube. Incubate at room temperature for 2 h, mixing every 15 min;

e) After incubation, the tubes shall be centrifuged at 9 280 x g for 5 min, or

2 320 x g for 20 min, at 20 °C. Collect the resulting supernatant taking care to avoid the pellet. A sterile 47 mm filtration assembly with a 0.22 um polycarbonate filter shall be aseptically constructed. Wash the filter with 10 ml of TSB broth just prior to the filtration to minimize MS-2 Coliphage adsorption to the filter. Filter the supernatant;

and

Ne

The MS-2 Coliphage suspension is to be titrated as in C-6.2.2. The concentration of

MS-2 Coliphage should be 10 to 10? pfu/ml.

C-6.2.2 Enumeration of MS-2 Coliphage plaques

a) Thaw a cryogenically frozen E. coli ATCC host strain and inoculate 0.1 ml of the stock

suspension in one TSB tube. Incubate the TSB tube at 37 °C for 15 h to 18 h;

Liquefy 1 Yo TSA and temper in a 45 °C water bath. Prepare room temperature 1.5 percent TSA plates;

c) Serial dilutions of MS-2 Coliphage suspension shall be made using sterile PBS. 107 to 10°! dilutions (1 ml dilution per plate) shall be plated in triplicate on 1.5 Yo TSA plates. In a sterile tube, 1 ml of diluted MS-2 Coliphage shall be transferred. Add 0.1 ml of E. coli cells quickly to ~ 5 ml of melted 1 Yo TSA. The inoculum and media shall be vortexed and poured on TSA plates, with rocking plates to spread inoculum evenly. After the | percent

TSA layer has solidified, the plates shall be inverted and incubated at 37 °C for 15 h to 18 h; and

d) After incubation, plates containing 20 to 200 distinct plaque forming units (pfu) shall be

enumerated using a Colony Counter. The MS-2 Coliphage suspension titer shall be calculated by multiplying the number of pfu obtained by the inverse of the dilution factor.

The concentration of MS-2 Coliphage should be 10!° to 10! pfu/ml.

C-6.2.3 To prepare 100 litres challenge water, use appropriate quantities of the viral suspension in the general test water specified in section C-2, for a final viral count between 10* to 10° pfu/ ml, verified by the counts of plaque forming units (pfu) in a colony counter.

C-7 METHOD OF CHALLENGING RO TEST SYSTEMS AND SAMPLE COLLECTION

C-7.1 Install and condition the new RO system as per the manufacturer’s instructions. After flushing with general test water, connect the system to the microbiological influent challenge water feed at the maximum recommended inlet pressure and allow at least 10 litres of product water to filter and drain away with the product water storage tank tap open. Then close the storage tank tap and allow the tank to fill until automatic cut-off. In case of direct flow models (where no storage tank is provided), allow 10 litres of product water to flow before collecting samples.

C-7.2 Collect 500 ml of water samples from the influent challenge water tank and the product water storage tank in duplicate and analyse for the microbiological contaminants as per methods

specified in 5, Table 1. For direct flow models, collect product water samples from the outlet faucet.

C-7.3 If the system has a TDS control mechanism employing RO-bypass blending, all microbiological reduction testing will be done with the TDS control valve in full-open position (maximum flow in the bypass line).

C-8 ANALYSIS OF WATER SAMPLES FOR MICROBIOLOGICAL REDUCTION

TESTING

C-8.1 Enumeration of E. coli in Influent and Product Water Samples

C-8.1.1 Bacteriological water samples should be stored at (5 + 3) °C. Analysis should be commenced on the same day as sample collection.

C-8.1.2 For enumeration, serial dilutions of the influent and product water samples (10° to 105) shall be made using sterile PBS.

C-8.1.3 Method of enumeration shall be as specified in col (5) of Table 1.

C-8.1.4. The ŒE. coli suspension titer shall be calculated by multiplying the number of cfu

obtained by the inverse of the dilution factor. Results shall be expressed as the number of cfu/100 ml.

C-8.1.5 Use appropriate positive and negative controls to eliminate errors due to bacterial strain,

diluent or culture media.

C-8.2 Enumeration of MS2 Coliphage Plaques in Influent and Product Water Samples

C-8.2.1 Virological water samples should be stored at (5 + 3) °C. Analysis should be commenced on the same day as sample collection.

C-8.2.2 Serial dilutions of the influent and product water samples (10° to 10-5) shall be made

using sterile PBS. 10° to 10° dilutions shall be plated in duplicate on 1.5 percent TSA plates. In

a sterile tube, 1 ml of diluted MS-2 Coliphage shall be transferred. Then quickly add 0.1 ml of E.

coli host to ~ 5 ml of melted 1 percent TSA. Vortex the inoculum and media and pour on TSA base plates with rocking to spread the inoculum evenly. After the 1 percent TSA layer has solidified, the plates shall be inverted and incubated at 37 °C for 15 hto 18h.

C-8.2.3 After incubation, plates containing 20 to 200 distinct plaque forming units (pfu) shall be

enumerated using a Colony Counter. The MS-2 Coliphage suspension titer shall be calculated by

multiplying the number of pfu obtained by the inverse of the dilution factor. Results shall be expressed as the number of pfu/ ml.

C-8.3 Challenge Verification

After the appropriate incubation period for MS-2 Coliphage and E. coli, the colonies shall be counted on all of the density determination plates. The mean number of microorganisms per ml for plates with 25 to 250 colonies/plaques shall be calculated. This shall verify that the challenge organism was present in the challenge test water at the optimum concentration before conducting the challenge reduction test.

C-9 DETERMINATION OF REDUCTION LOG

The bacterial or viral log reduction is calculated as follows:

Input Load os

pfu/ml

Logo (Input) =

Output Load (mean) =

pfu/ml

Logio (Output) = ooo

Logio Reduction = Logio (Input) — Logio

(Output)

cfu/100 ml or

cfu/100 ml or

(Input load - Output load)

Percentage reduction =

Input load

C-10 SAFETY PRECAUTIONS AND HAZARDS

a) Steam sterilized samples and equipment shall be handled with protective gloves

when being removed from the autoclave;

b) Cryogenic culture vials shall be handled with cryoprotective gloves; and

c) All microbiological samples and contaminated test supplies shall be steam-

sterilized to 120 °C at 15 psi for a minimum of 20 min prior to being discarded.

ANNEX D

(Clauses 6.3.3.2.1 and Table 2)

EVALUATION OF MICROBIOLOGICAL REDUCTION - SPECIFIED PROTOZOANS USING INACTIVATED CYSTS AND MICROSPHERES

D-0 GENERAL

Cryptosporidium and Giardia are often identified during waterborne disease outbreaks. As they are less sensitive than most bacteria and viruses to conventional drinking water treatment methods, they are ideal candidates for protozoa group representation. This method, based on size

exclusion principle, prescribes the use of irradiated cysts of Cryptosporidium parvum or fluorescent polystyrene microspheres of similar physical dimensions [> 95 percent in the (3.0 + 0.15) um size range] for the evaluation of removal of protozoans (Cryptosporidium, Giardia lamblia, Entamoeba histolytica) or their oocysts (the resistant stage in the life cycle of waterborne protozoa that may be found in surface drinking water supplies and includes oocysts of Cryptosporidium and Toxoplasma and cysts of Giardia and Entamoeba). The method given at D-1 shall be the referee method in case of dispute and either of the methods given at D-1 or D-2 may be used as the routine method of test.

ALL SPECIFICATIONS OF THE RO PLANTS SHOULD BE AS PER IS 16240 : 2023 ,AS AND WHEN STANDARD REVISED.

SECTION 8:

DRAWINGS

DELETED

SECTION 9:

BILL OF QUANTITIES

(Annexed in Karnataka Public ProcurementPortal separately)

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).

(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees.

(3) Where there is a discrepancy between the rate in figures and words, the lower of the two will govern. [ITT Clause 24.1(a)]

(4) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITT Clause 24.1 (b)]

SECTION 10:
FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ [name of Employer]
_____ [address of Employer]
WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract");
AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;
AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;
NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ [amount of guarantee] [63]_Rupees_____ _____[in words], and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee][64] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.
We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.
Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

[63] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

[64] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract.